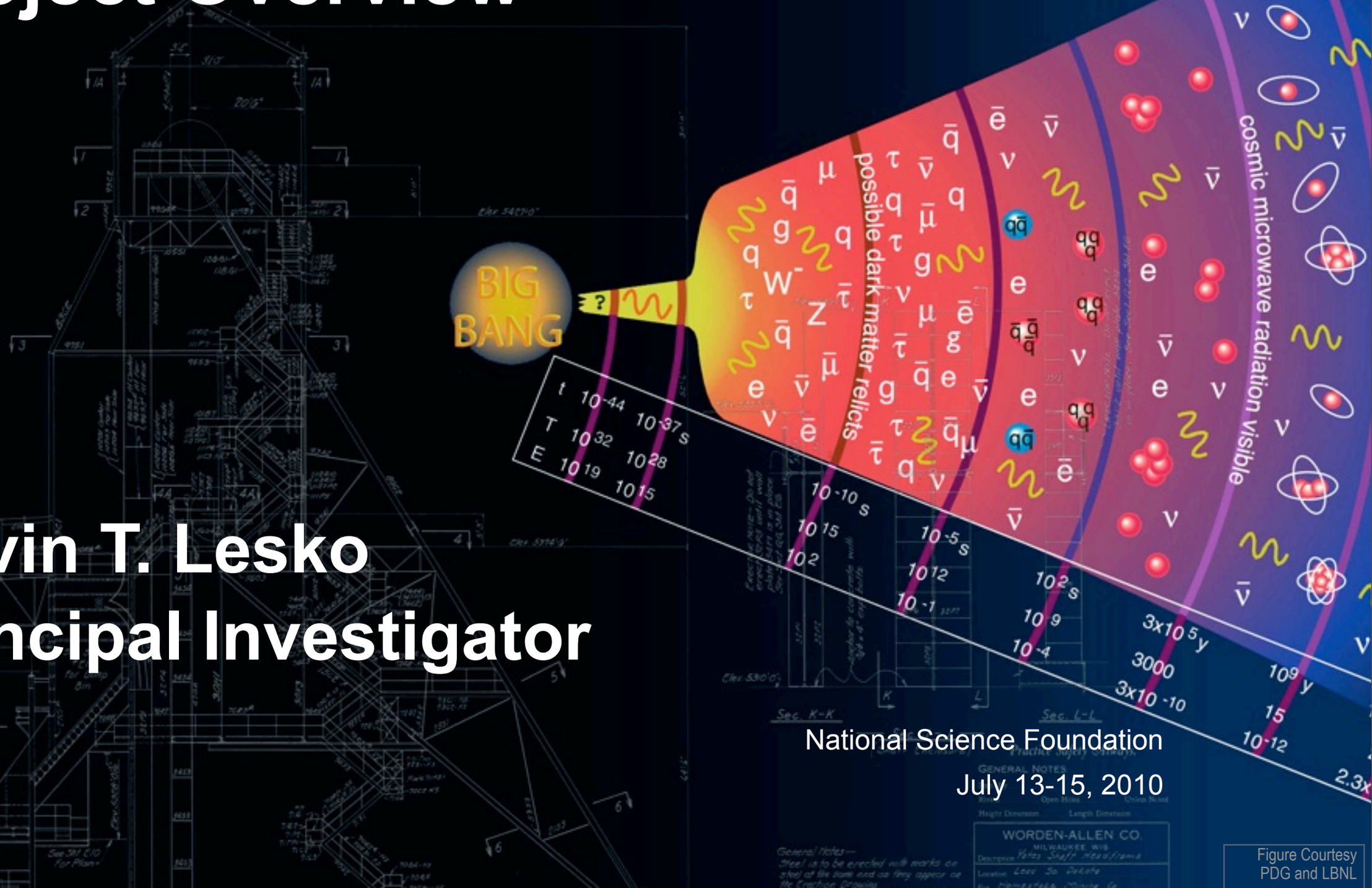
Homestake DUSEL
Science Proposal Reviews

Project Overview



Kevin T. Lesko
Principal Investigator

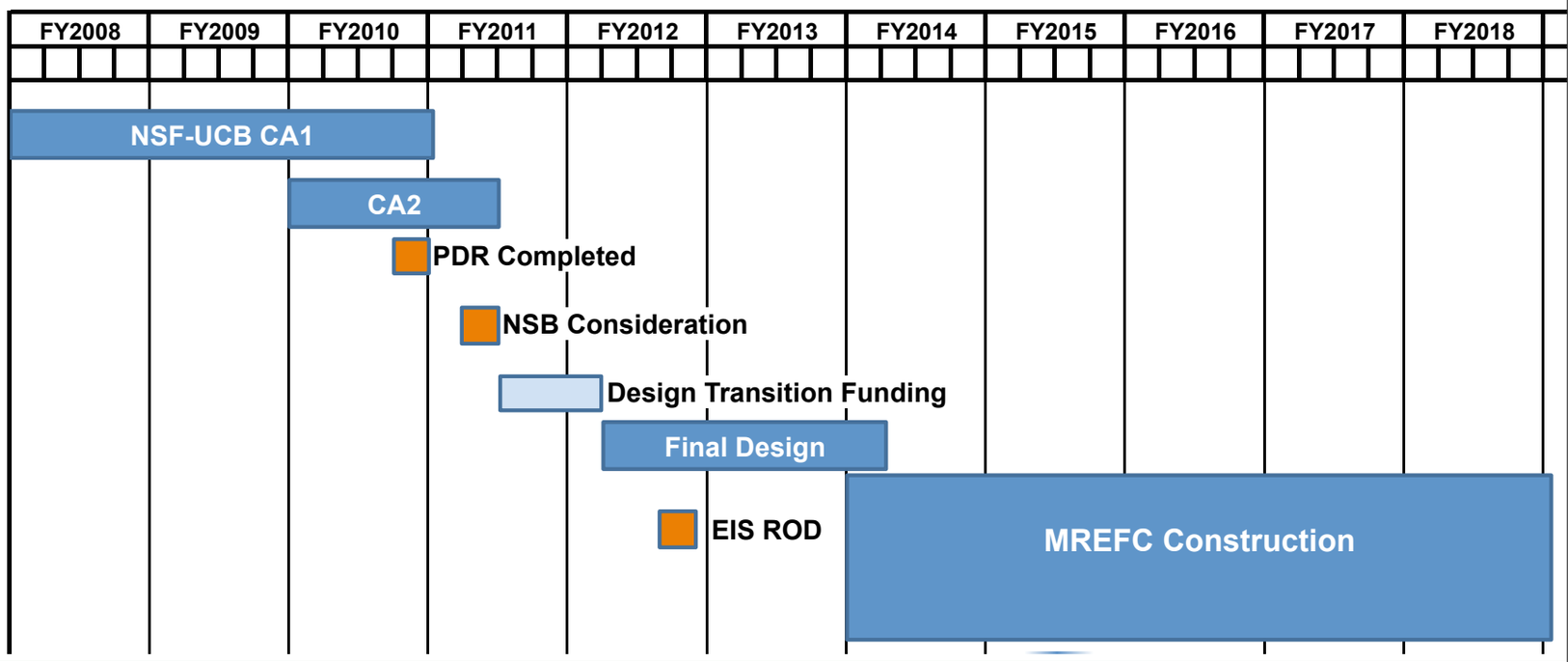
National Science Foundation

July 13-15, 2010

Figure Courtesy
PDG and LBNL

Presentation Overview

- FY10 Project status and updates
- FY11 Activities - reducing Project risks
  - –Continued design & experiment integration efforts
  - –Safety enhancements and deferred maintenance
  - –Safe underground access and facility maintenance
- Summary



DUSEL is extensively addressed by the Scientific Communities, Agencies, National Academy Reports

- Bahcall Committee Report 2001
- Nuclear Physics Long Range Plan 2002
- Connecting Quarks to the Cosmos
- HEPAP Long Range Plan 2003
- Neutrinos and Beyond
- EarthLab
- Physics of the Universe
- The Neutrino Matrix
- Earth Scope
- Discovering the Quantum Universe
- Deep Science
- Nuclear Physics Long Range Plan 2007
- 2008 P5 Report
- 2009 PASAG
- **2010 NRC Study is underway**

Why Are We Developing DUSEL?

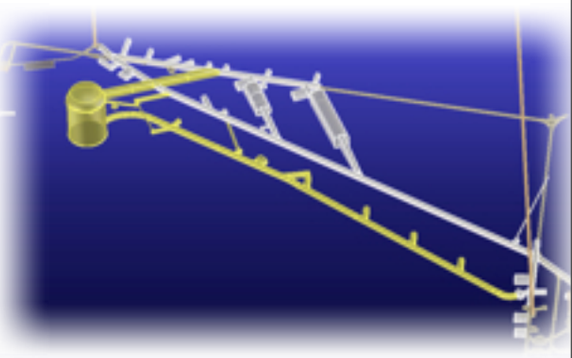
To enable the Science, exploit synergisms, maximize the benefits of a dedicated facility, and integrate Education and Outreach functions

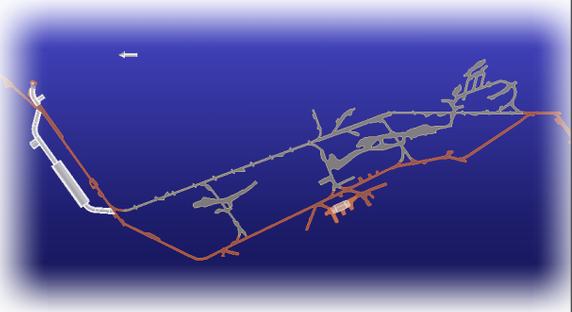
- Neutrinos - discover new physics, known-unknown physics
- Dark Matter - identify ~25% of the known-unknown universe
- Dark Life - limits of life, life in extremes, life in isolation, new life
- Origin of the Elements - how, where did the elements originate
- Symmetries and High Energy Scale Physics - matter/antimatter asymmetry, the universe at extreme energies and physics of the early universe -- the Intensity Frontier
- Natural Resources - understanding, probing, predicting
- Engineering - safer, deeper, larger, faster
- Energy and Carbon Research - imperative societal questions
- Education and Outreach - welcome, attract, excite, engage

DUSEL's Broader Impacts

- Comprehensive Education and Outreach Center and efforts spanning multiple scientific disciplines - excellent opportunities to expose diverse populations to multidisciplinary science
- Involvement of underrepresented minorities, notably American Indian and rural populations - excellent opportunities to provide real and lasting involvement
- Interagency Cooperation on Large Scale Science - new ground/scale for interagency cooperation
- Scientific and Engineering questions of significant sociality impact including carbon sequestration and construction techniques - long term laboratory for underground studies

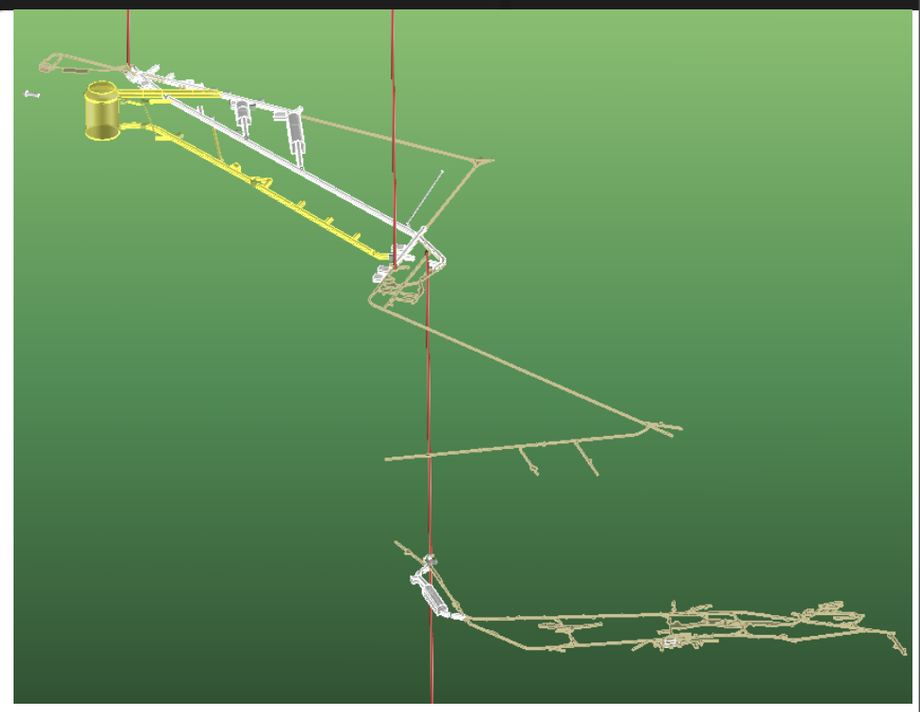
Reviewing the DUSEL Project





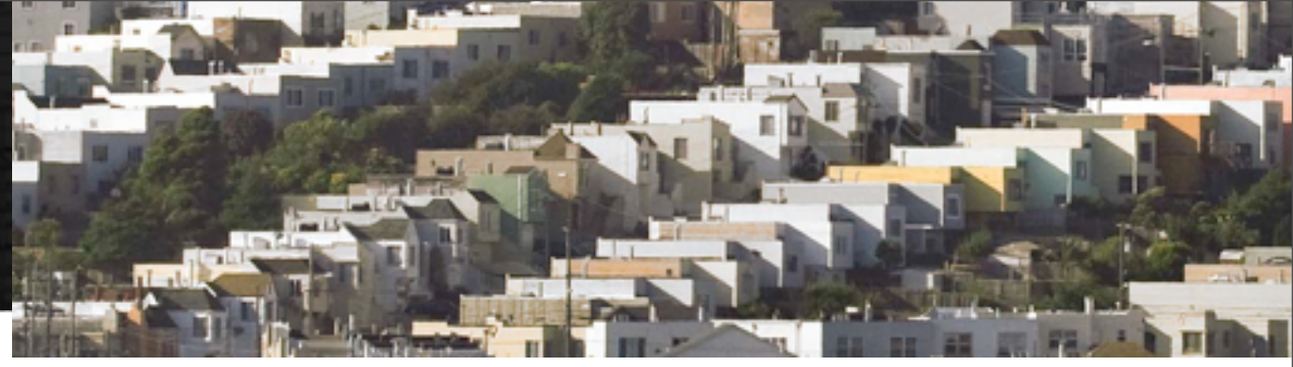
- DUSEL will be a Major Research Equipment and Facility Construction (MREFC) Project
  - Facility
  - Suite of Compelling Multidisciplinary Experiments
- Updated Agency Guidance - FY14 start
  - Facility (NSF Stewardship)
  - Long Baseline Neutrinos + Proton Decay (DOE HEP Stewardship)
    - CD0 - Jan. 2010, LBNE Project Team Senior Leadership Established
  - Neutrinoless Double Beta Decay (DOE NP Stewardship)
  - Dark Matter (NSF Stewardship)
  - Additional experiments (NSF Stewardship)
- Proposal & CDR championed Early Implementation Program
  - Requires operational EH&S program while DUSEL's full programs are being crafted - Project working closely with SD to realize this

Facility Design Refined Following Interactions with the Collaborations, in particular LBNE



- **World-Class Facility**
  - Research Campuses
    - Surface Campus (~27,000 m^2/ 1100 m^2 total/assembly)
    - 4850L (~25,000 m^2 /10,000 m^2 total/science)
    - 7400L (~5000 m^2 /1800 m^2 total/science)
    - Other Levels and Ramps (~30 km: ~50/50 ops/sci)
  - Dual Access to Research Campuses
  - Best-practices Life Safety Systems and Programs
  - Experimental Support
  - Design Enabling Future Expansion
  - Project Enabling Participation by Other Agencies
- **Suite of Transformational Scientific Experiments**
  - Diverse and Compelling Suite of Experiments
  - Integral Education and Outreach Efforts

MREFC Project Scope: On-going Iterations



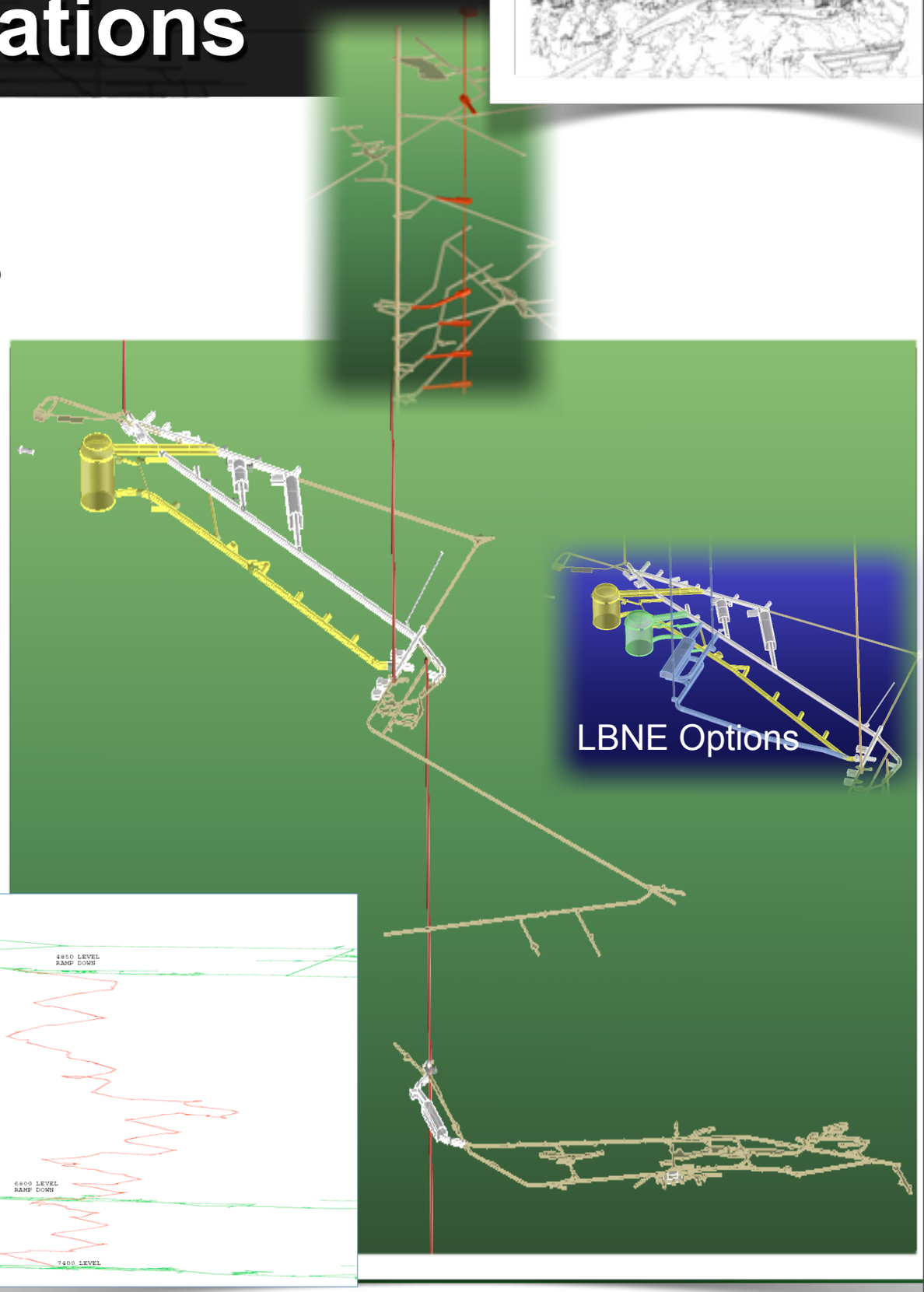
- Draft Multidisciplinary Generic Suite of Experiments (GSE)
- Developed Facility supporting this GSE based on concepts, parametric estimates and scaling arguments
- Iterate and Value Engineering on the Facility Design work with science collaborations
- Factor in Agency discussions and assumptions
- Working with the Agencies to understand the Science support within the NSF and between NSF and DOE
- Science is recognized to require additional support for both operations and construction

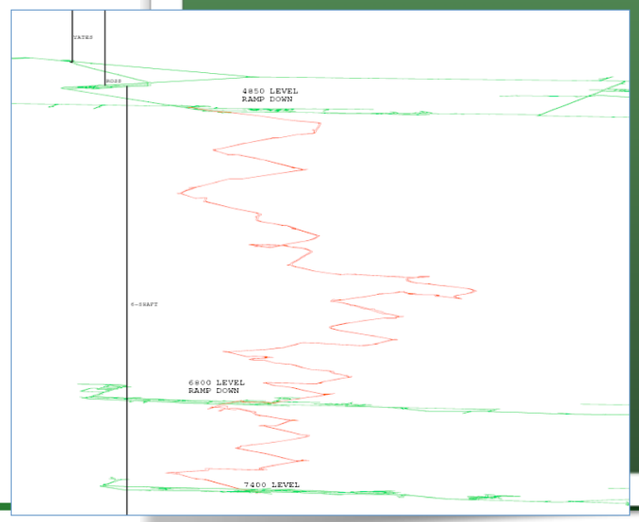
NSF MREFC Scope	Targets including Contingency
DUSEL Project Office	$48M
Surface Campus* (+ $5M from Sanford)	$50M
Underground Infrastructure and Laboratories*	$480M
LBNE Science Contribution	$123M
Other Science Contributions	$50M
	$750M

* including LBNE support

Facility Design Refined Following Interactions with Collaborations

- **Surface Campus**
  - 2 Simultaneous Installations
- **0 to ~1700L** (Vertical Expts)
- **4850L**
  - 1 Large Cavity (+ Options)
  - 4 - 5 Physics Experiments
  - Earth Science Experiments
- **7400L**
  - 2 Physics Experiments
  - Earth Science Expts
- **Other Levels & Ramps**





Integrating the Suite of Science Experiments into the Facility Design: Program Advisory Committee

Mike Witherell, UCSB

Physics Chair

Mark Zoback, Stanford

Earth Science Chair

Allen Caldwell, *MPI*

Boris Kayser, FNAL

Hitoshi Murayama, *IPMU & UCB*

Peter Parker, *Yale*

Michael Ramsey-Musolf, *U. Wisconsin*

Heidi Schellman, *Northwestern*

Abe Seiden, *UCSC*

Yoichiro Suzuki, *U. Tokyo*

Don DePaolo, *UCB and LBNL*

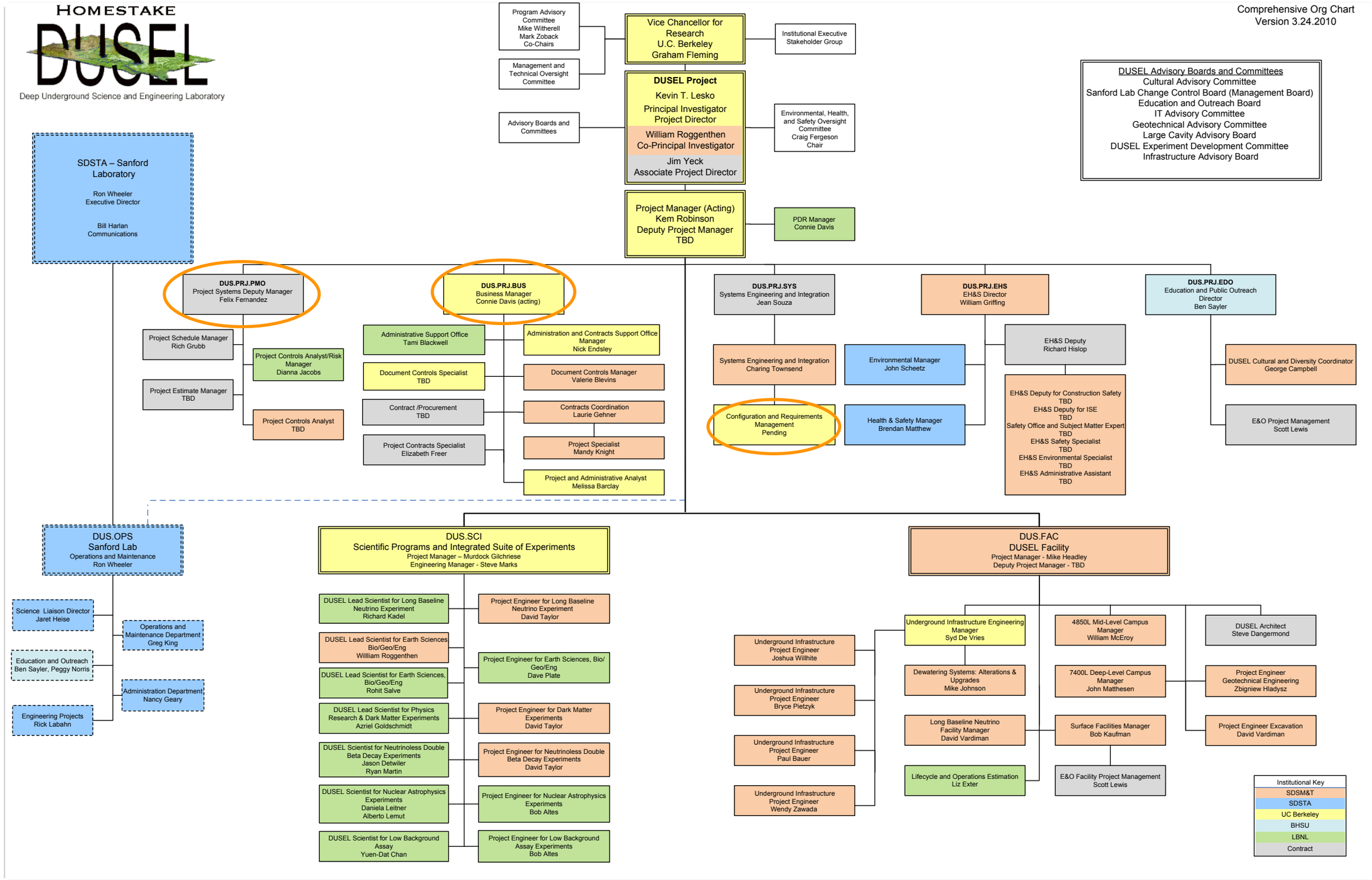
Steve Hickman, *USGS*

Art McGarr, *USGS*

Patricia Sobecky, U. Alabama

Provide an independent assessment of DUSEL's proposed Generic Suite of Experiments - 1st meeting 27-28 July in Berkeley.

The DUSEL Organization Nearly Complete: ~55 Staff Members



Milestone Schedule to Complete the Preliminary Design

Design Packages and Design Activities	2010 April	May	June	July	August	September	October	November	December	2011 January	February	March	April	May
Deep Campus Conceptual Design	▲													
Surface Campus Conceptual Design	▲													
Underground Laboratories	▲				▲		▲							
Underground Infrastructure	▲				▲		▲							
Excavation Design	▲				▲		▲							
	60% Preliminary Design			**90% Preliminary Design**			**100% PDR**	**Advancing Design Elements and Integrating Experiments**						
DUSEL Construction Management and Project Team				▲ Input to 90% Documents ▲ Consolidated 60% Packages			▲ Consolidated 90% Packages ▲ Consolidated 90% Estimate							
DUSEL and LBNE Project Teams	▲ Proposal FY11 Activities		▲ Proposal for CA2 Supplement					▲ Draft Preliminary Design Report	▲ LBNE CD1					
DUSEL, LBNE, Science Collaboration Reviews, Agency Meetings				▲ S-4 Physics Review ▲ LCAB IAB ▲ S-4 BGE Review ▲ PAC Meeting ▲ Sanford Lab/DUSEL Safety Review			▲ NSB Retreat	▲ Review of Preliminary Design					▲ NSB Meeting	
								Transition to New M&O		▲				

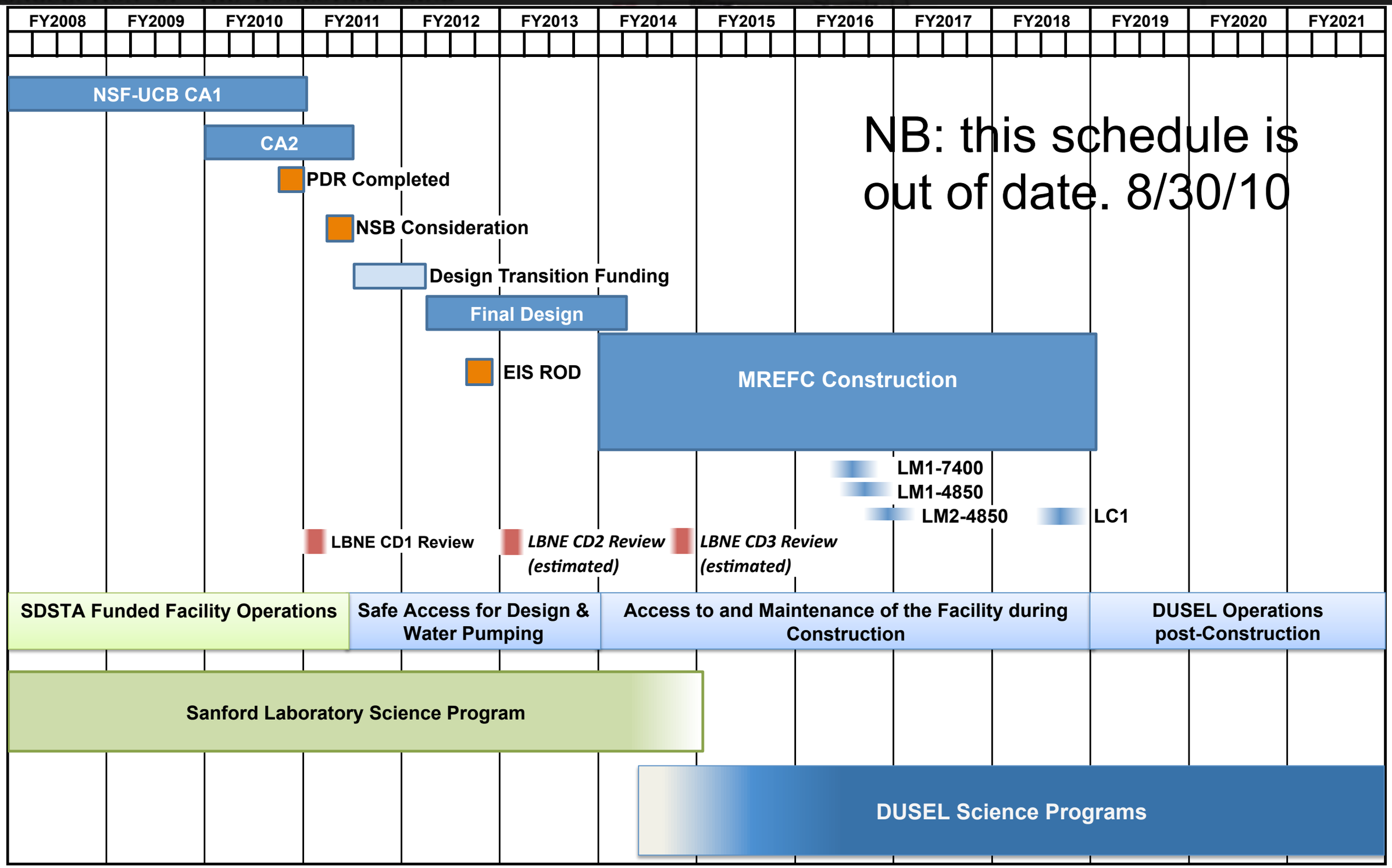
Advancing DUSEL's Preliminary Design and Maintaining Project Schedule

- Golder Excavation Design
  60% Report 16 June 2010 ✓
- HDR Surface Campus
  100% Report 13 May 2010 ✓
- Arup Laboratory Design
  60% Report - 01 June 2010 ✓
- Arup Laboratory Infrastructure
  60% Report - Draft - 07 June 2010 ✓
- Golder Preliminary Geological/ Geotechnical Assessment 4850L
  Synthesis Report - 8 April 2010 ✓
- CM providing independent estimates and value engineering exercises
- Project-wide integration and optimization efforts

Project Status

- DUSEL Project Team Nearly Fully Staffed
  - ~55 FTE Berkeley and South Dakota Offices
    - replacements sought for specific managerial positions
  - ~90 FTE SDSTA
- On track for completing Preliminary Design in 2010
  - 4 Architectural/Engineering contractors delivering 60% reports
  - CM firm establishing independent cost estimates and assisting with Value Engineering activities
  - Experimental Integration Efforts maintaining momentum
  - Scientific Requirements Management & Systems Engineering ramping up

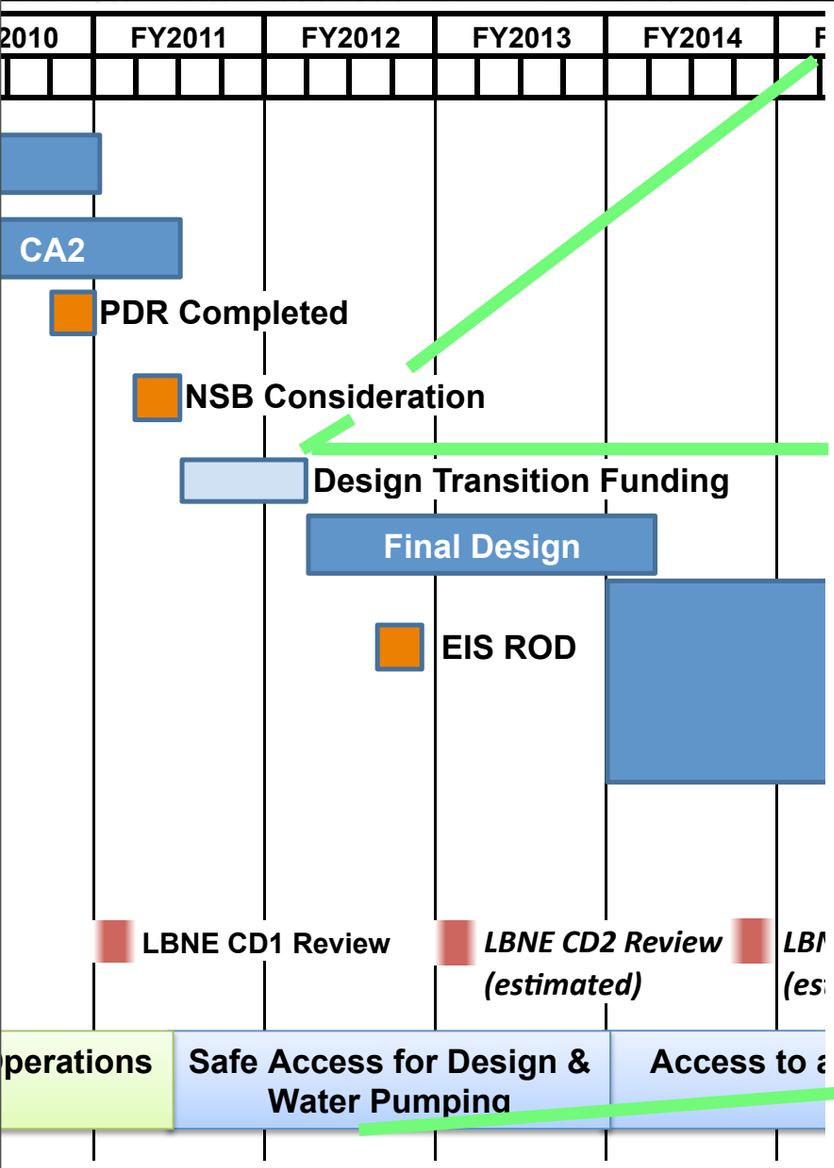
Project Milestone Schedule through Construction



NB: this schedule is out of date. 8/30/10

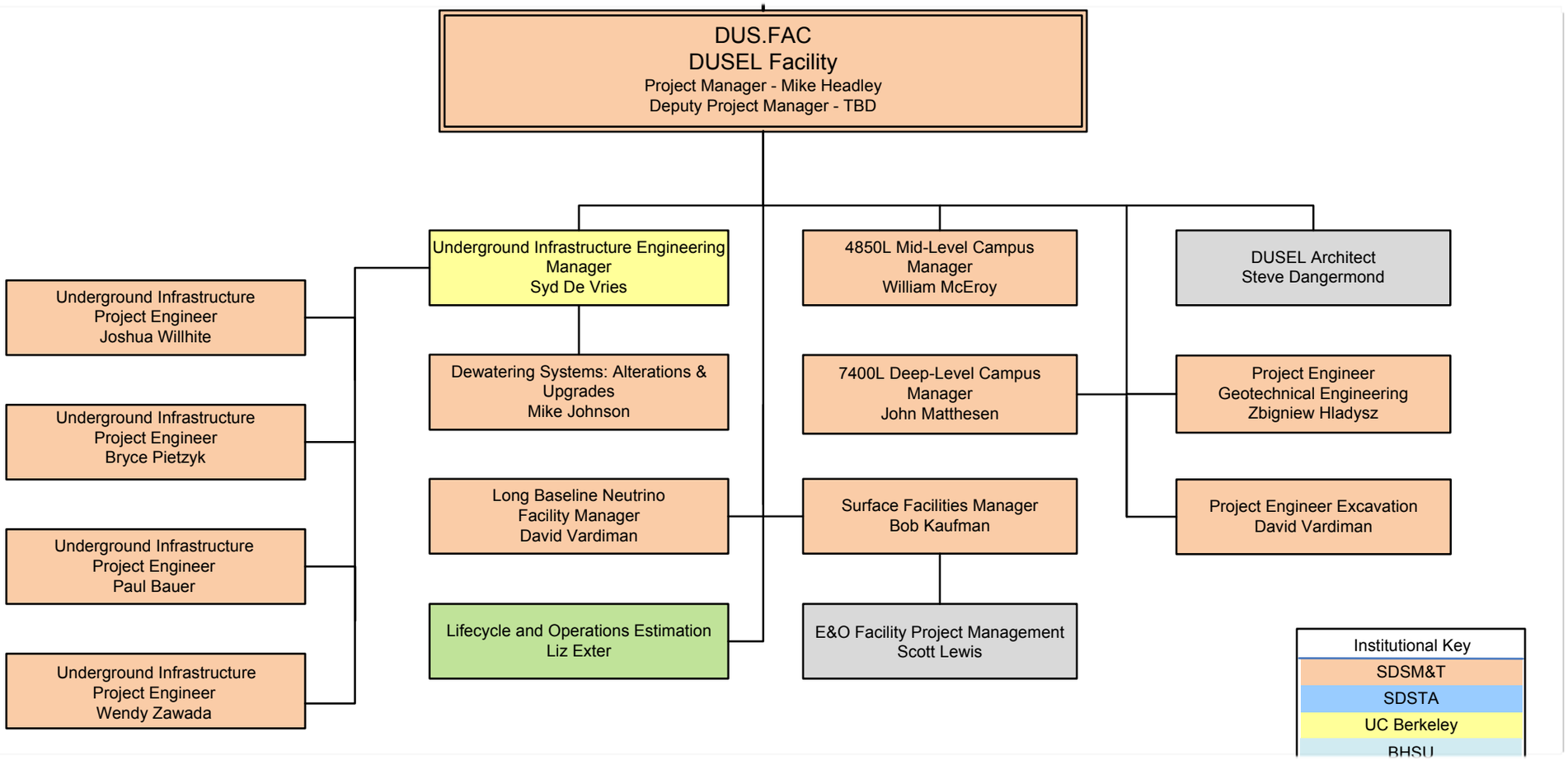
*these are 30% PD, non-optimized Beneficial Occupancy Estimates

Project Milestone Schedule through Construction



- DUSEL Project Team
  - Design advancement and experiment integration
- A/E Contract Extensions, principally in 2 contracts
  - Geotechnical Site Assessments at the 4850L
  - Surface Assessments
- Support for Safe Access and Facility Maintenance
  - Infrastructure and Safety Enhancements, Deferred Maintenance

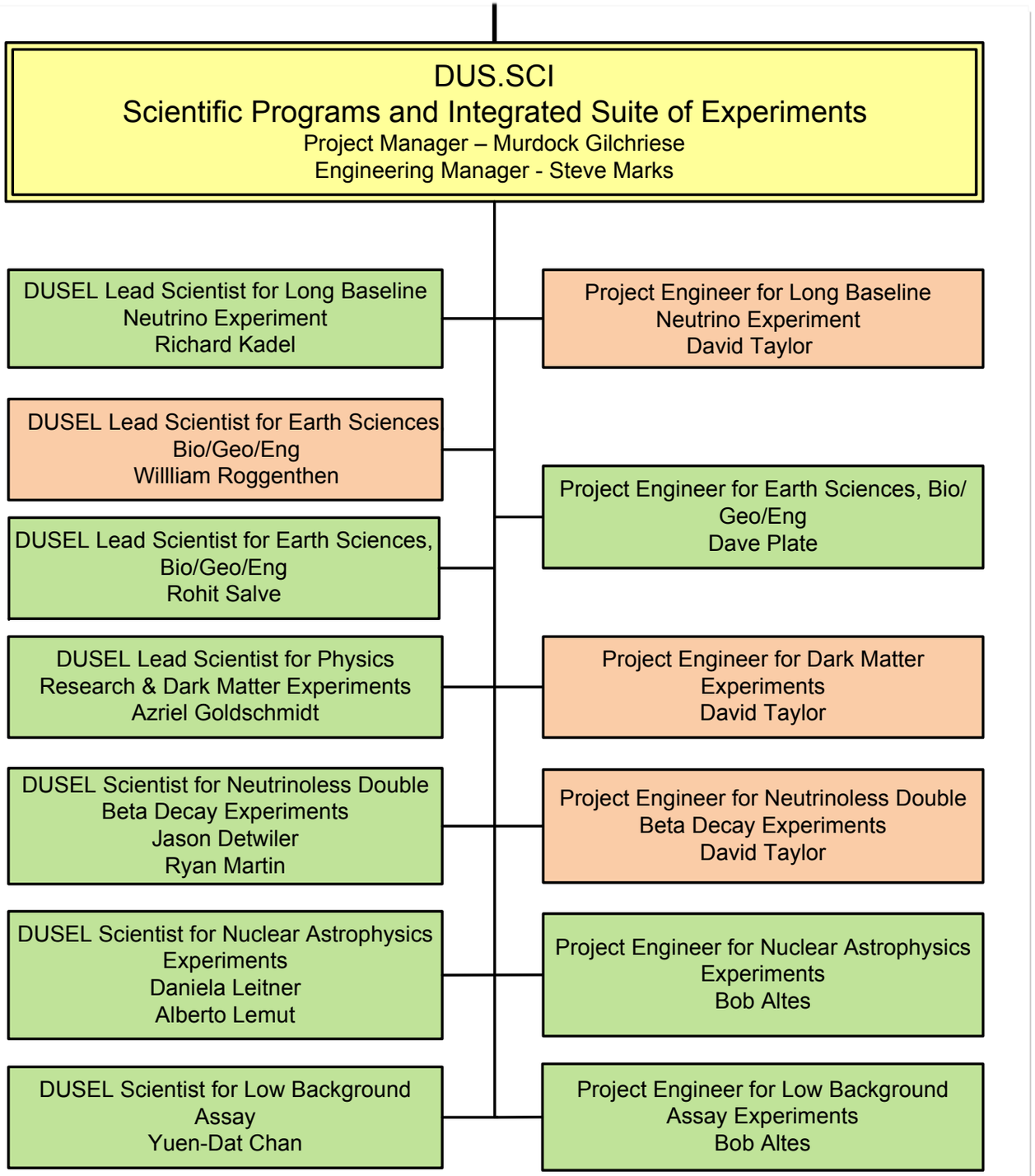
Facility Design Team



Large Cavity and Infrastructure Advisory Boards Meetings July 6-10

De Vries - Arup (Underground Infrastructure & Laboratory Design)
Vardiman - Golder (Excavation Design & Geotechnical Assessments
Kaufman - HDR (Surface Facilities)

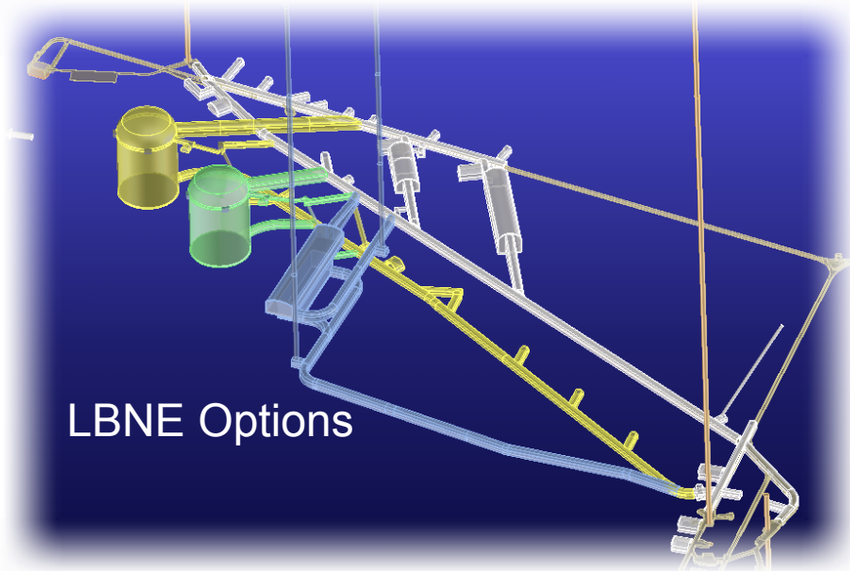
Science Integration Team



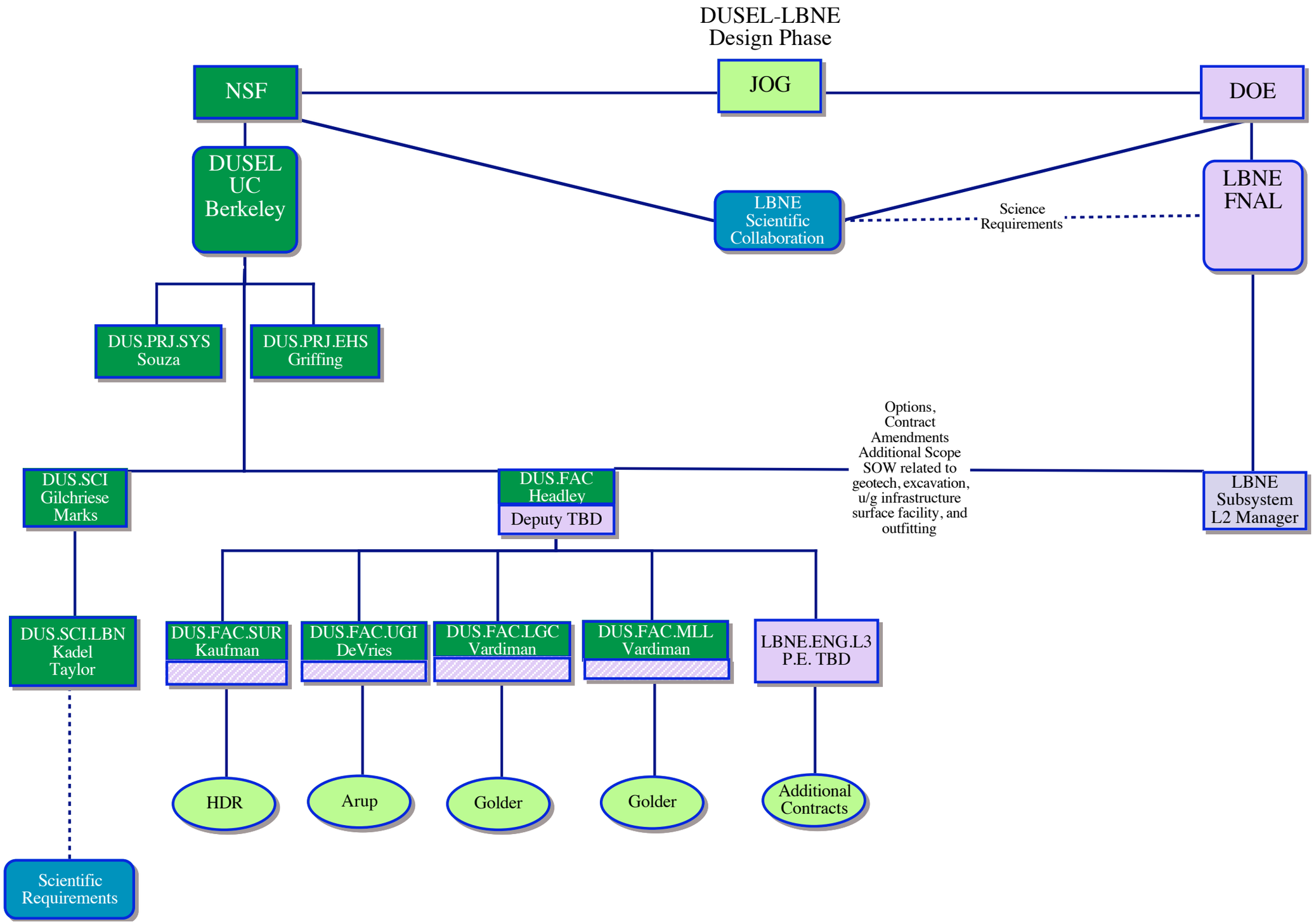
- Gil will discuss in greater detail

Long Baseline Neutrino Experiment Efforts

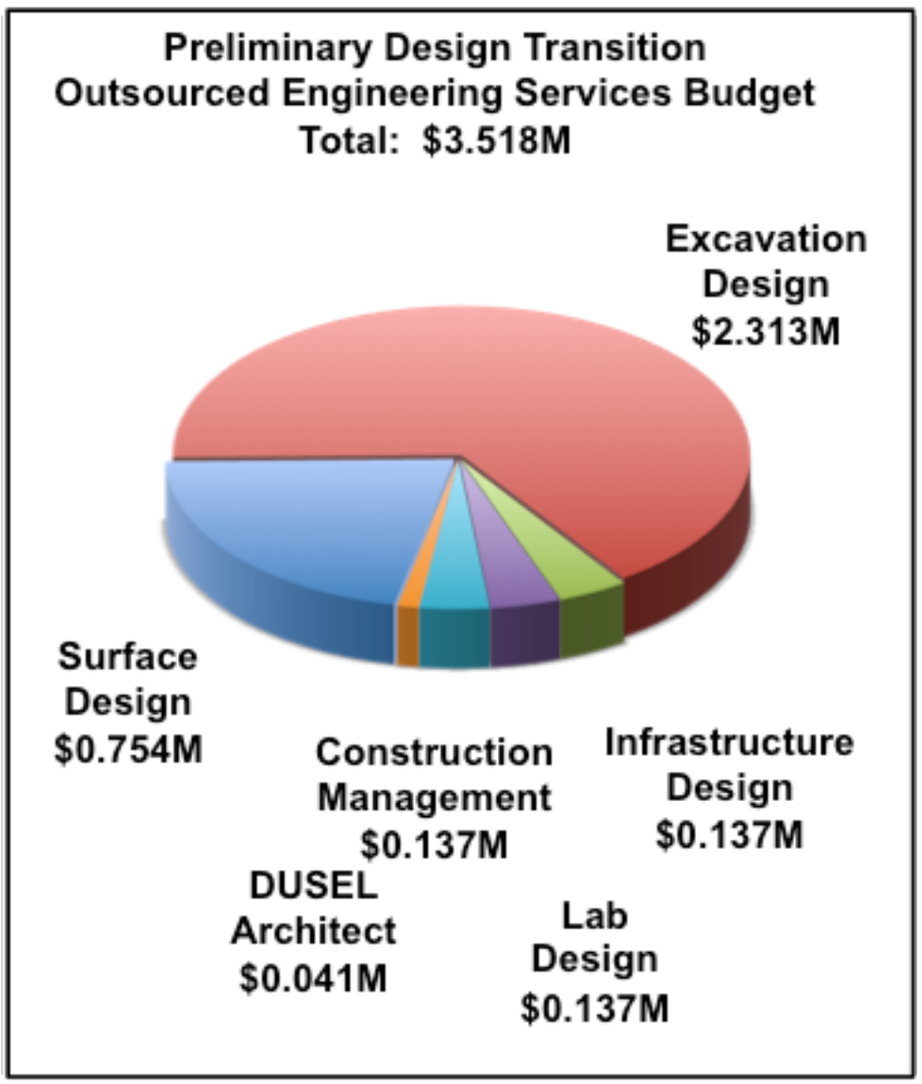
- LBNE Project Team expanding
- Continued integration into DUSEL plans
- LBNE-based additions to the Excavation Design Contract
- LBNE-based additions to the Surface Assessment Contract



Science Integration: Melding the LBNE Organization with DUSEL



A/E Contract Extensions for the Transition Proposal Period



- Excavation Design
  - Geotechnical studies including core drilling, *in situ* and laboratory testing, geologic mapping, laser scanning, 3D Geo Model updates, design of an exploratory drift to support LC#1 site selection and refine site characterization
  - Continued technical support to integrate underground designs with the surface designs and evolving experimental requirements
- Surface Design
  - Assessment of surface buildings and campus infrastructure; State Historical Preservation Office assessment
  - Identify the existing surface site conditions and environmental hazards
  - Provide parametric cost estimates for reuse / rehabilitation of assessed items
  - Initial surface design development

Summary

- FY10 efforts will see the completion of the Preliminary Design Report
- FY11 efforts will see
  - continued unification of efforts between Sanford Lab and DUSEL
  - continue critical contractor activities
  - enhance the safety infrastructure
  - perform critical maintenance
  - maintain facility upkeep including water pumping
  - provide safe access to the underground for design & assessment activities